FLOOD INSURANCE STUDY

VILLAGE OF CATSKILL, NEW YORK
GREENE COUNTY

SEPTEMBER 6, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER 360287

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

Initial Flood Insurance Study Effective Date: September 6, 1989

Flood Insurance Study Revised:

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FLOOD INSURANCE STUDY
VILLAGE OF CATSKILL, GREENE COUNTY, NEW YORK

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Village of Catskill, Greene County, New York, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by McCoy-Jackson Associates for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1603. This work was completed in October 1987.

1.3 Coordination

On March 1984, an initial Consultation and Coordination Officer's (CCO) meeting was held with representatives of FEMA, the village, and McCoy-Jackson Associates (the study contractor) to determine the streams to be studied by detailed methods.

Information concerning the history of flooding in the study area was provided by Village of Catskill officials and residents, the New York State Department of Environmental Conservation (DEC), and the U. S. Geological Survey (USGS).

On September 26, 1988, a final CCO meeting was held with representatives of FEMA, the village, and the study contractor to review the results of this study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Village of Catskill, Greene County, New York. The area of study is shown on the Vicinity Map (Figure 1).

Catskill Creek and the Hudson River were studied by detailed methods for their entire lengths within the community. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through October 1992.

2.2 Community Description

The Village of Catskill is located on the eastern edge of Greene County in the capitol district of New York State. The village is bordered by the Town of Greenport to the east, and the Town of Catskill to the north, west, and south. The village occupies an area of approximately 2.7 miles. According to the 1980 census, the population of the village was 4,750 (Reference 1).

Catskill Creek flows in a southeasterly direction to its mouth at the Hudson River. The creek has an average slope of 20 feet per mile and a drainage area of 370 square miles at its mouth.

The Hudson River flows in a southerly direction to its mouth at New York City. The river is an estuary in the vicinity of Catskill and is used for navigation to connect New York Harbor with the Erie Canal to Buffalo and the Great Lakes.

The climate of the Village of Catskill is characterized by moderately warm summers and cold winters. The mean July temperature is approximately 73 degrees Fahrenheit (^{o}F), while the mean January temperature is approximately 29^{o}F. The mean annual precipitation over the area is approximately 40.0 inches. Precipitation in the form of snowfall and sleet occurs mainly in the months of December through March with an average annual snowfall of approximately 43 inches (Reference 2).

2.3 Principal Flood Problems

Flooding can occur in the study area during all seasons, but generally the most notable floods have occurred between the months of February and April when snowmelt adds to heavy spring rains to produce increased runoff. Summer and fall floods also occur due to hurricane activity.

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CATSKILL, NY

(GREENE CO.)

APPROXIMATE SCALE

0 8 16 24 MILES

VICINITY MAP

2.4 Flood Protection Measures

Non-structural measures of flood protection are being utilized to aid in the prevention of future flood damage. These measures are in the form of land use regulations which control building within areas that have a high risk of flooding.

There are no flood protection measures located within the Village of Catskill.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

The Hudson River is an estuary in the Village of Catskill. High tides produce higher flood elevations than fluvial flows, so peak discharges were therefore not computed on the Hudson River.

Catskill Creek at the Village of Catskill is a large, rural basin. A USGS gage is operated upstream in Oak Hill and has 65 years of systematic record. A log-Pearson Type III analysis of this gage data was prepared by the New York State DEC to compute peak discharges at the gage site for various return periods (Reference 3). This gage data could not be directly used in this study reach because the drainage area at the study reach is almost four times the drainage area at the gage. Instead, a COE Regional Frequency

Study was used that incorporated gage data throughout the Upper Delaware and Hudson River Basins to formulate regression equations for computing peak discharges for ungaged streams (Reference 4). The parameters of drainage area, mean annual peak flood, standard deviation, and skew are used in the regression equations.

A summary of the drainage area-peak discharge relationships for the stream studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CATSKILL CREEK					
At confluence with the Hudson River	370	25,300	42,700	52,000	79,000

The stillwater elevations for the 10-, 50-, 100-, 500-year floods have been determined for the Hudson River and are summarized in Table 2, "Summary of Stillwater Elevations."

TABLE 2 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HUDSON RIVER				
At downstream corporate limits	7.6	8.7	10.6	13.1
At upstream corporate limits	7.8	10.1	11.1	13.7

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analysis of the stream studied by detailed methods were obtained from aerial photogrammetry using photographs taken in March 1985, and were mapped at a scale of 1"=400' with a contour interval of 4 feet (References 5 and 6). The below-water sections were obtained by field measurement. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1) and the Flood Insurance Rate Map (Exhibit 2) where applicable.

The starting water-surface elevation for Catskill Creek was taken from the Hudson River tidal elevations.

For Catskill Creek, water-surface elevations of floods of selected recurrence intervals were computed through the use of the HEC-2 step-backwater computer program (Reference 7).

Channel roughness factors (Manning's "n") used in the hydraulic computations for the streams studied by detailed methods were chosen by engineering judgment and based on field observations of the streams and floodplain areas. For streams studied by detailed methods, the channel "n" value ranged from 0.020 to 0.030, and the overbank "n" values ranged from 0.080 to 0.120. An "n" value of 0.015 was used for concrete structures and 0.024 was used for corrugated metal pipes. A weighted average "n" value was used for bridges with steel decks, concrete abutments, and earthen bottoms. Non-effective flow areas were disregarded by using extremely high "n" values. The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was checked by calibrating computed flood profiles to known historic flood profiles.

For the Hudson River, tidal elevations of floods for selected recurrence intervals were linearly interpolated between the elevations reported in the Flood Insurance Study for the Town of Stockport and those reported in the Flood Insurance Study for the Town of Saugerties (References 8 and 9).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 6).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 3). The computed floodways are shown on the Flood Insurance Rate Map (Exhibit 2). In cases

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Catskill Creek								
A	2,000	310	6,690	7.8	10.8	10.8	10.8	0.0
B	4,000	302	6,188	8.4	11.8	11.8	11.9	0.1
C	6,500	302	6,158	8.4	16.4	16.4	16.7	0.3
D	7,400	294	6,825	7.6	18.4	18.4	18.7	0.3
E	8,100	447	8,199	6.3	19.9	19.9	20.3	0.4
F	9,200	406	7,696	6.8	21.5	21.5	21.6	0.1

[1]Feet above confluence with the Hudson River

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

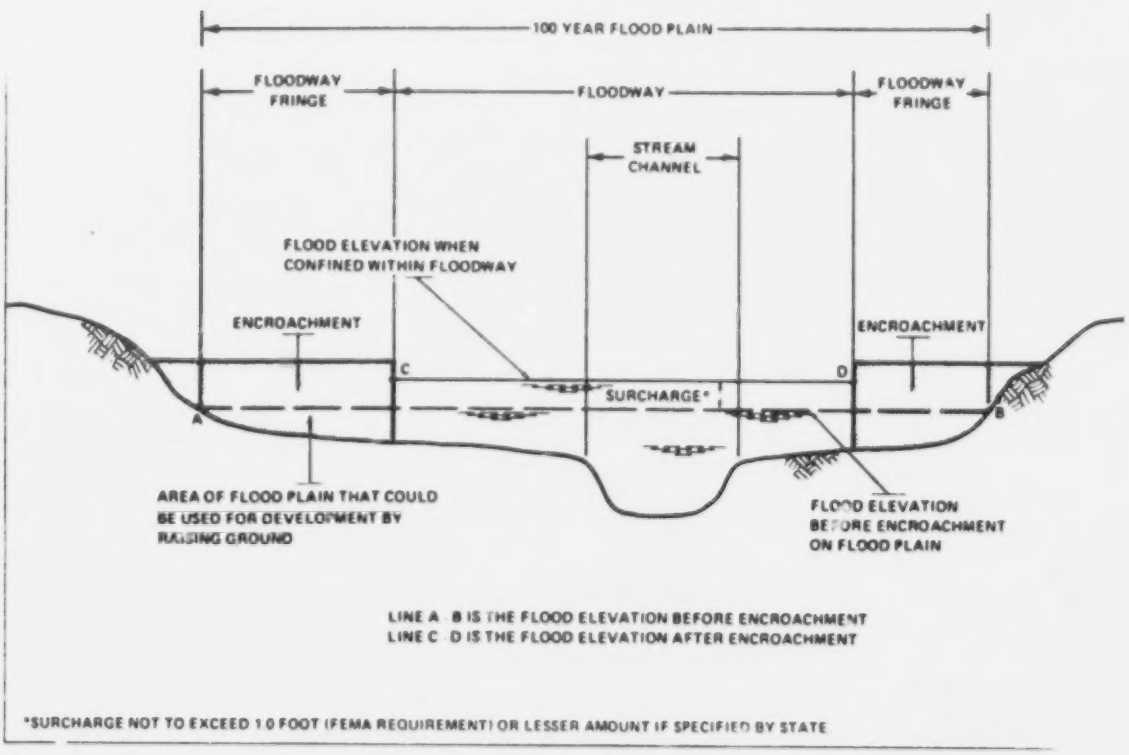
VILLAGE OF CATSKILL, NY
(GREENE CO.)

FLOODWAY DATA

CATSKILL CREEK

where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

Floodway Schematic - Figure 2

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. The zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not

performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown within this zone.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no base flood elevations are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, and to areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year floodplains. Floodways and the locations of selected cross sections used in the hydraulic analyses and floodway computations are shown where applicable.

7.0 OTHER STUDIES

Flood Insurance Studies are currently being prepared for the adjacent Towns of Catskill and Greenport (References 10 and 11). The results of those studies will be in exact agreement with the results of this study.

Due to the more detailed information, this study supersedes the Flood Hazard Boundary Map for the Village of Catskill (Reference 12).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, 26 Federal Plaza, Room 1351, New York, New York 10278.

9.0 BIBLIOGRAPHY AND REFERENCES

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9. Federal Emergency Management Agency, Flood Insurance Study, Town of Saugerties, Ulster County, New York, Washington, D. C., August 19, 1985.

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11. Federal Emergency Management Agency, Flood Insurance Study, Town of Greenport, Columbia County, New York (Unpublished).

12. U. S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Village of Catskill, Greene County, New York, revised March 26, 1976.

Ven Te Chow, Open-Channel Hydraulics, New York, McGraw-Hill, 1959.

U. S. Department of Commerce, Weather Bureau, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, Washington, D. C., 1961, Revised 1963.

EXHIBIT 3 - ELEVATION REFERENCE MARKS

Reference Mark	Elevation (Feet NGVD)	Description of Location
RM 1	156.75	USGS disk no. W-75-1935 set in top of stone railing at west end of Rip Van Winkle Bridge on north side of State Route 23, approximately 28 feet east of west end of curb.
RM 2	72.78	Large PK nail set 1.0 foot up gate post on east side of access road intersection with Grand View Avenue, approximately 875 feet from intersection of Grand View Avenue and Red Apple Lane.
RM 3	30.54	USGS disk no. T-72-1935 in concrete railing at southeast corner of U. S. Route 9W bridge over Catskill Creek.
RM 4	17.79	USGS benchmark no. U-72-1932 in concrete and steel railing at southeast corner of State Route 385 (Bridge Street) bridge over Catskill Creek.

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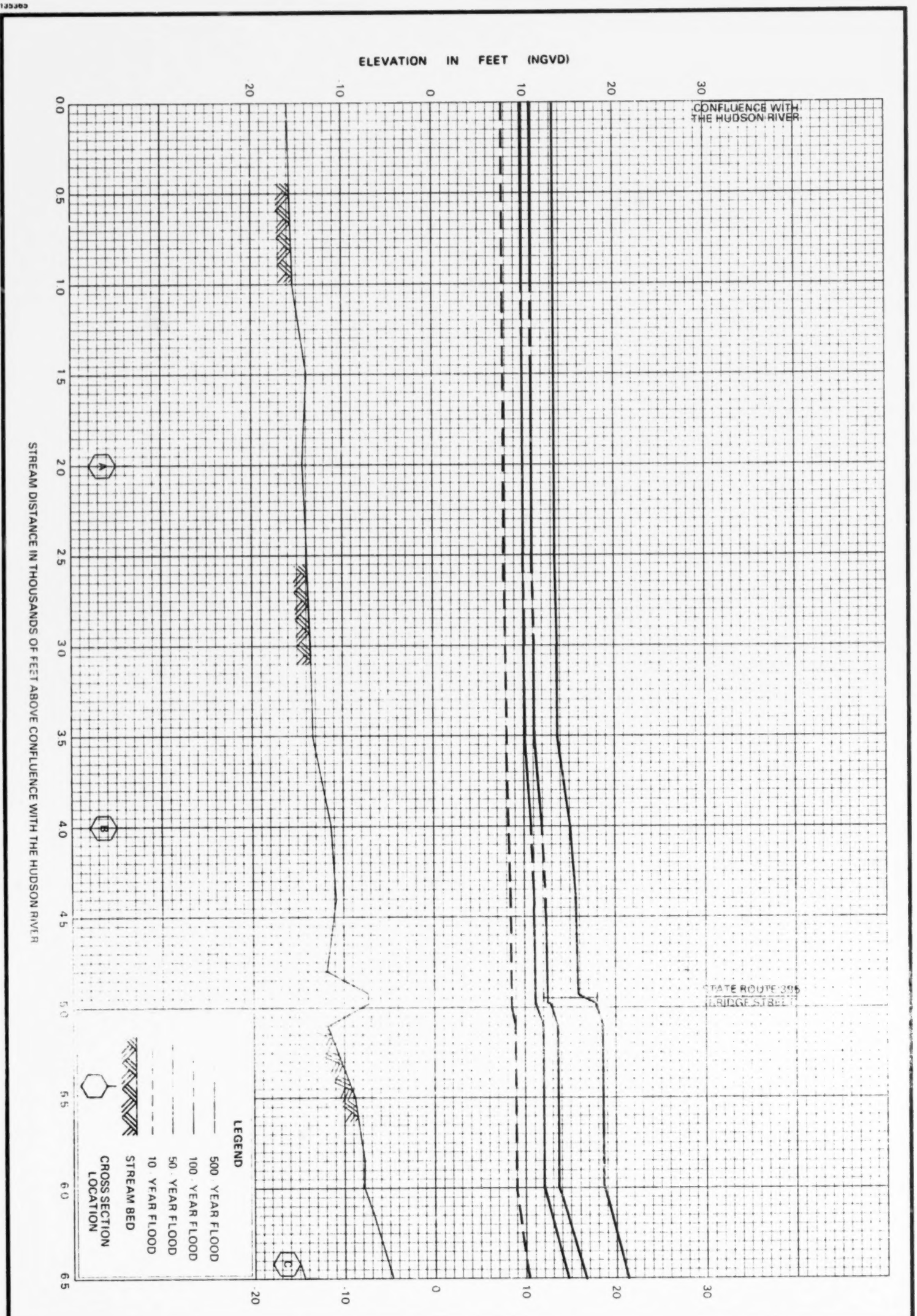

01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **VILLAGE OF CATSKILL, NY** (GREENE CO.)	**FLOOD PROFILES** **CATSKILL CREEK**

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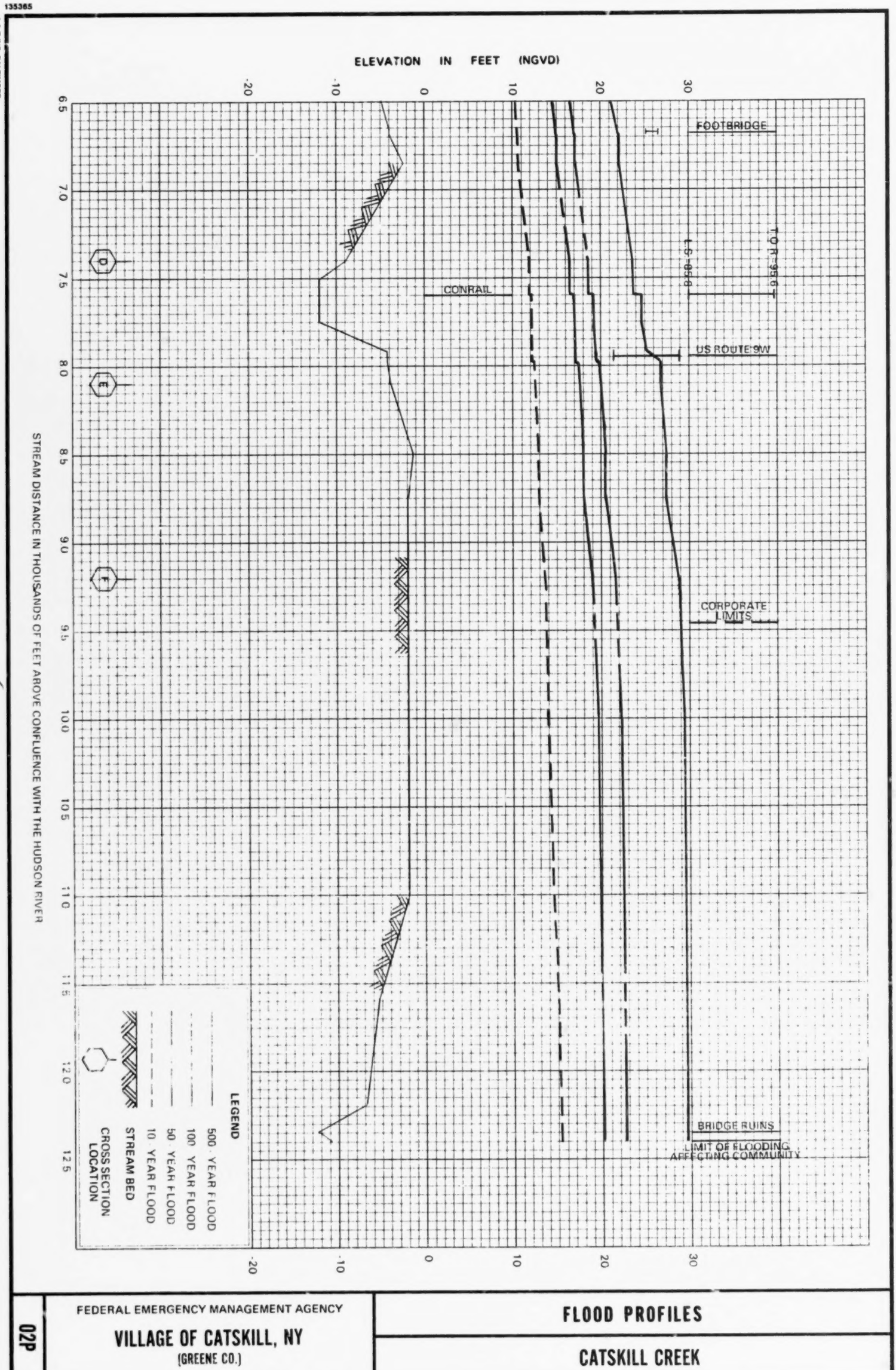

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02P

FEDERAL EMERGENCY MANAGEMENT AGENCY

VILLAGE OF CATSKILL, NY

(GREENE CO.)

FLOOD PROFILES

CATSKILL CREEK